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ABSTRACT

A study of microcomputer courseware reviews was carried out in order to discover which criteria they discuss, whether reviewers agree in their assessments, how evaluative the reviews are, and whether the reviewing policy of the journal influences the review. The content analysis instrument was a composite of criteria developed by organizations that evaluate courseware. A total of 53 variables were included within the following classification scheme: (1) program description and summary; (2) technical aspects; (3) subject matter content; (4) instructional design; (5) presentation; (6) student use; (7) teacher use; (8) review process; (9) evaluation summary; and (10) other miscellaneous considerations such as support materials and field testing. Reviews of ten widely-reviewed logic/problem-solving courseware packages were chosen for study, and content analysis was performed on 147 reviews. Data obtained show that few of the evaluation criteria are used in published reviews and that these reviews are largely descriptive. When reviews do evaluate they are positive and uncritical in nature. It is concluded that courseware reviews need to be improved and that the language of evaluation needs to be standardized. Definitions of evaluation criteria and a list of 25 references are appended. (MES)

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Evaluations of Educational Microcomputer Courseware/Software: A Content Analysis of Published Reviews

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Evaluations of Educational Microcomputer Courseware/Software: A Content Analysis of Published Reviews

While schools in the United States are purchasing microcomputers at an increasing rate in their response to the perceived potential of a new technology, the apparent motivating effect on students, and the advocacy of parents, there is concern about the quality of courseware being developed. One aspect of selecting courseware and other educational materials is obtaining information about their effectiveness. A standard source of information for educators and librarians has been reviews published in journals. Studies have been done which investigated published reviews of media--books, films, filmstrips, and videodiscs. However, a search of the literature did not reveal any study of reviews of microcomputer courseware. It seemed timely to study courseware reviews to find out which criteria they discussed, if reviewers agreed in their assessments, how evaluative the reviews were, and whether the reviewing policy of the journal influenced the review.

Method

The research strategy included developing an instrument that could be used for a content analysis and selecting programs that had been reviewed widely enough to provide sufficient material to analyze. Editors of journals would be contacted for information about reviewing policies.

The content analysis instrument was a composite, formed of criteria developed by organizations that evaluate courseware, for example, EPIE, Microsift, and Alberta Education. Criteria are well developed, many having been used for older forms of material, such as books, particularly in the area of content. Classification of criteria and their definitions, however, differed from form to form. The classification scheme used in the instrument closely follows that of M.D. Roblyer (1983). Each variable was carefully defined in order to form discrete categories for the analysis (Appendix A).

The variable, Student Tryout, which appears in eight out of the thirteen forms used (and in the

reviewing policy of Educational Technology) has been cited in the literature as the most important factor in a good evaluation because students perceive courseware differently than adults. One fairly new criterion, Innovative Use of Computer, has been incorporated in a few forms, and attempts to differentiate the ordinary programs from the extraordinary. As a result of the pilot study conducted, a few criteria were added: Problem Solving Skills, Instructional Component, Cueing Techniques, and Monitoring.

Rating scales used in evaluation forms vary from form to form depending on whether the quality of the criterion is expressed in the item: The scale is tied to the way the criterion is written. A Likert-type scale is very commonly used. However, some forms use no ratings at all, but are entirely narrative, while a few forms ask for an overall rating. In general, the development of rating scales has been neglected in evaluation. One exception to that trend is Owston's (1985) evaluation instrument with defined scales. As a result of the pilot study, in which a Likert-type scale was not feasible, a simple three part scale was used in the study: positive, negative, or mixed (having elements of both).

Logic/problem solving courseware was chosen for study because the programs seemed to be the most innovative and would be likely to elicit more extreme resposes from reviewers. Using TESS: The Educational Software Selector (EPIE, 1985), and Digest of Software Review--Education (n.d.), the most widely reviewed logic/problem solving programs were picked. They were: Chess 7.0, Dragon's Keep, The Factory, Gertrude's Puzzles, Gertrude's Secrets, Incredible Laboratory, Pinball Construction Set, Rocky's Boots, Snooper Troops, and Troll's Tales.

Although there are many journals which review courseware, it is very difficult to pinpoint a review of a particular program. The best sources of citations of reviews proved to be three online databases: Computer Database, Microsearch, and Microcomputer Index. Other sources of citations became evident through an examination of books about software programs, for example, The Whole Earth Software Catalog (Brand, 1984), and Only the Best: The Discriminating Software Guide for Preschool-Grade 12 (Mattas, 1985). Access or bibliographic control of

information concerning reviews of media have varying degrees of development, with book reviews the best developed, and microcomputer software, along with filmstrips, the worst.

The next step, of finding the reviews themselves, was also difficult, because few libraries carry a depth of journals in computing, which is where most reviews are published. Interlibrary loan was able to obtain some of the reviews--others were impossible to get, even from the publishers.

A content analysis was performed on the 147 reviews obtained. Fifty-three variables--46 evaluative and seven descriptive--were considered. Excerpts quoting reviewers' opinions of variable were recorded, many of which were incorporated into Chapter 4 of the dissertation (Bender, 1986). Ratings were recorded of reviewers' opinions--a simple positive, negative, or mixed. The data were processed to yield percentages; tables were constructed.

Results

The data obtained show that although many criteria have been developed, few are used in published reviews. Only sixteen out of the forty six evaluative criteria were used in 50% or more of the reviews. The percentage of use of a criterion ranged from a high of 76.9% for Instructional Component to 0% for Field Testing (which differs from Student Tryout in that field testing is done by the developers of the program, while student tryout is done by the evaluator). The evaluative criteria used most frequently were: Instructional Component (76.9%), Problem Solving Skills (75.5%), Visuals (59.2%), Suitable Level (57.8%), Student Ease of Use (53.7%), Motivation (68.7%), Recommendations (61.9%), and Support Materials (59.2%).

Since there is little evaluative content, published reviews of educational microcomputer programs are largely descriptive. When reviews do evaluate, they are positive in nature: most of the evaluative criteria that have been used have been rated as positive. Table 1 shows the ratings of criteria that have been used at the 50% or higher level for individual programs. Few variables have been rated as negative. Although the results of the analysis may be skewed toward the positive because the programs reviewed may be of a higher quality than the average

program, the results agree with research done on reviews of other media. In general, it is very typical that the better courseware programs are the ones that are reviewed. The findings agree with observations experts in the field, such as Alfred Bork (1985), have made concerning courseware reviews.

Insert Table 1 about here

Consistency of reviewers' opinions was part of the study. Since most opinions were positive, there was a high degree of consistency, although individual reviewers perceive qualities of a program differently. For example, in the reviews of Rocky's Boots, there was considerable disagreement concerning the criterion, Directions on Screen. Of the total of ten ratings, six were positive, two were negative, and two were mixed. Positive: Whole Earth Software Catalog (Brand 1984, p. 188), "The instructions are clear, thorough, and simple enough for any second grader--or for that matter, any self-conscious adult--to grasp with a little practice." Negative: EPIE (1983), "Although the developer states that this program is suitable for ages 7 and above, students between 7 and 9 will have considerable difficulty with it. For these students directions are difficult to read and follow." Mixed: Electronic Learning (Unwin, 1983), "The program does a good job of walking the player through the program directions, but when they get to the games, many children will run into problems. There should be more explicit instructions on playing these games, with examples."

A few of the variables were descriptive criteria, which comprised part of every review studied. Although all the reviews included some elements of Description and Summary, there was a wide range of detail covered. Alberta Education, EPIE, and MicroSIFT consistently provided valuable descriptive information. Because choosing software that is compatible with hardware and appropriate for the setting is confusing, especially for novices, the more detailed the information, the more helpful it is to selectors.

Another aspect considered in the study was whether individual journals used one rating predominantly. With the preponderance of positive ratings found for individual reviews, it was inevitable that the journals would reflect that positive inclination. In every journal except one, the ratings were primarily positive. The exception was Educational Technology, which had a higher percentage of negative than positive reviews (57.9% negative, 36.8% positive). Other journals that had the highest negative ratings were: CUE (Computer Using Educators), 33.3%; Electronic Learning, 20%; and The Journal of Learning Disabilities, 18.1%. In addition, it was found that some evaluation organizations had a fairly high usage of negative ratings: EPIE, 31.6%; Alberta Education, 20.8%; and California Library Consortium, 23.8%.

The investigation included finding out the reviewing policies of journals and what the relationship is between the policy and the ratings. 13 out of 32 publishers replied to the letter of inquiry. Few of the respondent journals have reviewing policies. Educational Technology is one of the rare journals that encourages negative criticism in its reviews. Again, this situation agrees with studies conducted on reviews of other media. The reviewing policy does seem to influence the nature of published reviews.

Conclusions

A review of the literature showed that reviews of media are positive and uncritical in nature. The same situation obtains for courseware reviews. A short descriptive review may convey no more information than an annotation in a publisher's catalog. Some critics have attributed this endorsement of courseware to a too cozy relationship with advertisers (Bean, 1986). Besides having a heightened sense of skepticism, the selector would be advised to look for evidence of student tryout. Although the study did not measure whether or not the evaluator mastered the program, in some reviews there were operational details that seemed to indicate that mastery of the program had not been effected. This is analagous to authors' contentions that reviewers do not read their books thoroughly.

The study showed that courseware reviews need to be improved--with more extensive descriptions and greater assessment of criteria. The language of

courseware evaluation needs to be standardized--with common definitions developed. Further, although checklists have their uses, in depth analytical evaluations provide more substantial information to the reader. Software reviews function more to keep educators aware of new items than as major inputs into the selection process. At present, there is no substitute for previewing a program and obtaining input from several students in the target population. The study verifies what the literature contends: that courseware evaluation is in the early stages of its development and should evolve into a more intelligent, higher level system.

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Appendix A

Definitions of Evaluation Criteria

DESCRIPTIVE REVIEW

1. Description

Program name, publisher, price, hardware requirements, version number, type of program, target population, subject area, specific topic, preview available.

2. Summary

Abstract of program content, purpose of the program, educational objectives, instructional strategy, or program structure (MicroSIFT, 1982, p. 13).

TECHNICAL ASPECTS

1. Program operation

The software program is free of programming and operational errors. It will load into the computer easily and will run consistently under all normal conditions (MicroSIFT, 1982, p. 35). Pressing keys other than specified will not interfere with the running of the program.

2. Input

Required student responses (including control characters) are consistent throughout the program and appropriate for the student population. Complex input procedures are kept to a minimum unless the procedures are justified by the learning objectives (Heck 1984, p. 15). Peripheral devices (printers, light pens, paddle controllers, joysticks, etc.) are used efficiently.

3. Response time

Displays and responses have a consistent rate; there is no undue delay.

4. Random generation

Exercises, words or items will not appear in the

same order each time the program is run (Blum, 1982, p. 127).

5. Technical documentation

The operation of the program, technical options and features are discussed clearly and completely in accompanying printed materials (EPIE, 1984, p. 7).

CONTENT

"Facts, terms, ideas, concepts, principles, theories, and constructs which make up the subject matter of an instructional package" (MicroSIFT, 1982, p. 9).

1. Quality of content

Factual information and terminology are accurate, complete, and up-to-date in the presentation and in questions and answers. Graphics, models, displays, and statistics are correct. Terminology is explained to the degree required by the target student population. There is an appropriate depth of information.

2. Educational value

The knowledge or skills to be learned have some relationship to school curricula or represent a value in life. The program can be utilized in an instructional situation.

3. Consistency with objectives

The content matches the objectives set by the program as demonstrated by the information required by the student to learn or by behaviors expected of the student.

4. Language

The language and grammar are correct, of the highest standard, and consistent in convention (punctuation, spelling, spacing) both on the screen (including directions and error messages) and in accompanying printed materials (Alessi, 1985, p. 376).

5. Reading level

Vocabulary, phrasing, and sentence length are appropriate for the subject level and student level.

6. Bias

The program is free of racial, ethnic, sex, and other stereotypes (Roblyer, 1983, p. 35).

7. Social characteristics

Moral issues are treated sensitively. This also applies to the format of the program, which may incorporate techniques that are questionable. For example, hangman games show capital punishment; many arcade type setups are based on war games (Heck, 1984, p. 17).

INSTRUCTIONAL DESIGN

"The instructional strategy used to implement the specific package content" (Poirot, 1984, p. 5).

1. Stated objectives

The objectives for the lesson are explicitly stated so that the student knows what the lesson covers. The objectives are considered useful and important (Alessi, 1985, p. 385), and they are stated in behavioral terms (Futrell, 1984, p. 75) when possible.

2. Prerequisite skills

The necessary abilities and knowledge needed by the student to understand the lesson are stated.

3. Testing

There is an adequate number of test items, at appropriate levels (Roblyer, 1983, p. 35). Tests place student in the program, measure student performance, reflect the objectives of the program, and are technically correct. The record of test results is accurate.

4. Clarity and logic

Concepts are presented in a well organized manner, in a recognized sequential order, using appropriate examples.

5. Instructional component

"The student gain[s] new skills or concepts from using the program" (Curriculum Review cited in Truett, 1984, p. 67).

6. Cueing techniques

"Hints/prompts/faded prompts, etc. [are] used effectively." (Clearinghouse of Alberta Education, n.d., p. 12.)

7. Feedback

"Refers to information that informs learners about the success or accuracy of their actions. Thus, feedback involves providing the learner with 'knowledge of results.'" (Mitzel, 1982, p. 1043).

Feedback is timely, nonthreatening, appropriate for the intended user. Feedback avoids reinforcing the wrong response, remediates when needed, explains why response was incorrect, does not detract from instructional message, does not slow down progress of student, and presents summary of scores at end.

8. Attention

The presentation engages the student's interest.

9. Problem solving skills

"Problem solving involves the most complex set of skills of all...instructional techniques. Going beyond simulation, it allows the learner to put into practice a range of concepts and skills necessary to solve a problem. The process as well as the solution is then seen to be applicable or adaptable to other problems with the same or similar characteristics" (NEA, 1983, p. 20)

10. Utilization of computer

The program is well suited to computer use, and is more than an expensive page turner (Hofmeister, 1984, p. 7.16). The computer is used in a dynamic, interactive way (MicroSIFT, 1982, p. 34) and "takes advantage of the computer's unique capabilities, such as response judging, graphics display, data collection, and branching" (Roblyer, 1983, p. 35).

11. Innovative use of computer

The program exhibits "unique features which distinguish it from other courseware" that are improvements in quality over previous software. (Media Evaluation Services, n.d. p. 3).

PRESENTATION

Instructional messages comprising text, graphics displays or other outputs (Alessi, 1985, pp. 314, 319).

1. Visuals

Graphics, animation, and color support and enhance the instructional process. Visuals stimulate student interest; they do not distract attention and learning. The visuals focus on important areas.

2. Sound

Sound enhances the instructional process; does not disturb others in the classroom; can be turned on and off. The quality of the sound is as good as possible.

3. Information displays

The screen is well formatted and uncluttered, without too much information presented at one time. There is adequate spacing, text is clear and easy to read. Character sets are appropriate for the students (MicroSIFT, 1982, p. 32). Text is well integrated with graphics. There is little scrolling (in which the text is put on the screen line by line with the previous lines being pushed up to make way for the new one) (Alessi, 1985, p. 75).

4. Menus

Options and how to choose them are clear. An incorrect choice is easy to correct by returning to the original menu. (Chances for error are lessened if pressing <return> is required after pressing a key to make a choice) (Alessi, 1985, p. 381).

5. Directions on screen

Instructions are concise and clear. Reading level is appropriate for the students and consistent with the text. "Help" procedures are available.

STUDENT USE

1. Suitable level

The content, structure, means of response, and time required are appropriate for the maturity and ability or handicap of the student. Levels of instruction exist for individual differences (MicroSIFT, 1982, p. 18).

2. Ease of use

The student understands how he is to interact with the program and can operate it in an independent manner (depending on the objectives of the program).

3. Learner control

The student can alter the rate of presentation, choose among content topics, activities, type of response, level of difficulty, or number of problems to be done. The student can review instructions, and exit the program at any time (and return to the place where he stopped).

4. Motivation

Using the software is a positive experience for the student, one that encourages him to learn. The tone of address is appropriate and effective for the student; reinforcement is positive and dignified (MicroSIFT, 1982, p. 19). After using the program, the student wants to use it again, or to learn more about the subject through a different source of information.

5. Creativity

The student is actively involved in learning. The student is encouraged to go beyond acquiring facts, to think deeply about the information and its implications, and applies the knowledge in a manner new to him. The program can handle a wide range of answers and interactions (MicroSIFT 1982, p. 19). The program provides a rich experience for the student: one that presents the process of learning as a positive human activity.

TEACHER USE

1. Ease of use

A teacher can easily operate the program without needing technical expertise.

2. Adaptability

The teacher can easily change the program through built in options to accomodate the ability level, the content, or the guidelines for use. Other choices can be made by the teacher: pace, number of problems, and criteria for mastery. This depends on the content, with spelling and math easier to control than social studies (particularly a simulation).

3. Monitoring

"A minimum amount of teacher supervision" needed while student runs the program (Clearinghouse of Alberta Education, n.d., p. 20).

4. Curriculum integration

The program fits into the course of study that is being taught.

5. Recordkeeping and management

Correct answers are tallied correctly. Recordkeeping and management are accurate, adequate, and easy to use.

REVIEW PROCESS

1. Team evaluation

More than one evaluator assesses the program. Ideally, the evaluators will have different areas of expertise (e.g. content area, instructional design).

2. Student tryout

Reviewers observe students from the intended audience use the software, take note of their problems, and interview them afterwards for their opinions (Roblyer, 1983, p. 38). (The literature singles out student review as the most important factor in evaluation.)

EVALUATION SUMMARY

1. Recommendations

The reviewer recommends purchasing or not purchasing the program (Roblyer 1983, p. 38) or revising and improving the program.

2. Strengths

Exemplary qualities in the program in relation to specific applications (Hofmeister, 1984, p. 7.18).

3. Weaknesses

Improvements needed in relation to specific applications (Hofmeister, 1984, p. 7.18).

OTHER

1. Support Materials

Accompanying printed materials are available, attractive, sturdy, meaningful, easy to use, and appropriate for the user. Documentation in the form of manuals accompanying the program includes complete descriptions of the courseware's instructional purpose, the target students, the scope of the contents, and all procedures for proper use. The manuals should be written in a clear, nontechnical style (Roblyer, 1983, p. 35). Other support materials, such as worksheets, flash cards, etc., should enhance the use of the CAI program (Hofmeister, 1984, p. 7.18).

2. Field Testing

There should be evidence that the producers field tested the program with an appropriate audience. Preferably, the field testing should be done by an independent unit (not associated with the developer) and should be used with large numbers of representative students for long periods under normal classroom conditions (Hofmeister, 1984, p. 7.18). Revisions should be based on actual findings of field testing (Roblyer, 1983, p. 35).

3. Achievement of purpose

The student learns "what the material sets out to teach, rather than merely being engaged in the process" (MicroSIFT 1982, p. 17).

4. Comparison to other programs

The program under review is assessed and compared in quality to another program.

Table 1

Criteria used at the 50% or higher level, by predominant rating

	CH	DK	FA	GP	GS	IL	PC	RB	ST	TT
TECHNICAL ASPECTS										
Program operation.....		+								
CONTENT										
Educational value.....		+						+	+	+
Reading level....		+								+
Social characteristics		+								
INSTRUCTIONAL DESIGN										
Clarity and logic.....								+		
Instructional component.....	+	+	+	+	+	+		+	+	+
Attention.....		+								
Problem solving skills...		+	+	+	+	+		+	+	+
Utilization of computer.....								+		
PRESENTATION										
Visuals.....	+	+	+	+	+	+	+	+	+	+
STUDENT USE										
Suitable level...	+	+	+	+	+	+		+	+	+
Ease of use.....	+	+	+	+			+			+-
Motivation.....	-	+	+	+	+	+	+	+	+	+
TEACHER USE										
Monitoring.....		-								-
EVALUATION SUMMARY										
Recommendations..	+	+	+	+	+		+	+	+	+
OTHER										
Support Materials.....	+-	+-	+	+-	+	+	+	+	+	

\+ = Predominantly positive
\- = Predominantly negative
+- = Equally positive and negative

CH = Chess 7.0
DK = Dragon's Keep
FA = The Factory
GP = Gertrude's Puzzles
GS = Gertrude's Secrets
IL = The Incredible Laboratory
PC = Pinball Construction Set
RB = Rocky's Boots
ST = Snooper Troops
TT = Troll's Tale